Buckley & Associates Ltd.

Report S167A

For

Roy Consultants Ltd.
Bathurst, New Brunswick

GEOTECHNICAL INVESTIGATION
PHASE IA
PROPOSED REGIONAL SOLID WASTE SITE
RESTIGOUCHE CO., NB

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June 18, 1992

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T. J. Buckley
PROVINCE OF NEW BRUNSWICK

Restigouche Solid Waste/S167A

TABLE OF CONTENTS

Page No.

1.0 INTRODUCTION

1.1 Terms of Agreement 1
1.2 Purpose 1

2.0 PROCEDURE

2.1 Existing Information 1
2.2 Reconnaissance 2
2.3 Testpits 3
2.3.1 Sampling 3
2.3.2 Laboratory Testing 4

3.0 GEOLOGY, TOPOGRAPHY

3.1 General 4
3.2 Site No. 119 5
3.3 Site No. 28 6
3.4 Site No. 24 6

4.0 GEOTECHNICAL CONDITIONS

4.1 Till 7
4.2 Groundwater 7
4.3 Bedrock 8

5.0 DISCUSSION & RECOMMENDATIONS

5.1 Site Morphology 9
5.2 Overburden Characteristics 9
5.3 Groundwater 11
5.4 Conclusions 11

6.0 CLOSURE 12

Appendices

I Testpit logs
II Laboratory Testing
III Location Plans

1.0 INTRODUCTION:

1.1 Terms of Agreement

This presents our Phase I report prepared in accordance with our proposal of April 1, 1991; furthermore with guidelines set forth in documents provided by the Restigouche Solid Waste Committee. This report supplements and is a continuation of our report S167 of October 7, 1991.

1.2 Purpose

The purpose of this investigation was to examine a total of three prospective sites, and to conduct assessments of their suitability, from a geotechnical viewpoint, for further study during the second phase investigation of the overall site selection.

2.0 PROCEDURE:

2.1 Existing Information

(Please refer to our Report S167)

...2

2.2 Reconnaissance

Two of the sites examined during this phase were located on the Belanger Road. The Orthophotos indicated that they were located in relatively inaccessible woodlands. Consequently, an aircraft was hired to obtain information regarding recent cutting roads. Site #28 was found to have been largely cut over and access was relatively straight-forward. However Site #24 was found to be in mature forested areas. (Cutting is progressing in areas about 1-2 km east of the of site #24).

The orthophotos revealed the outline of an old woods road north of the site running straight on a 245° azmith from the Belanger Rd. To gain access with the excavator a bulldozer was hired. This machine provided 2km of access to 4X4 vehicles to a point about 0.5 km north of the subject area. The dozer then provided rough access for the excavator to the selected testpit areas.

Topographic features, compass and string-chain or vehicle oedometer were used to locate the testpits.

The figures of appendix III show details of sites, observations, and testpit locations. Bedrock outcrops are noted with an "R" on the figures of appendix III.

...3

An existing woods road traverses the length of Site #119. This site was found to consist largely of a bedrock ridge with few flat areas. Bedrock outcrops were visible for its length as indicated on fig. 3, appendix III.

Fig. 1 shows a portion of aerial photography taken in 1991. Appendix III fig. 2 contains an orthophoto layout of the observations and testpit locations of site #24.

2.3 Testpits

Following our examination of data and ground observations, testpits were conducted on sites #28 and #24 to further assess the depth and nature of the overburden materials. A crawler type Case 888 backhoe was used. The results of these observations are diagrammatically shown on the logs of Appendix I.

2.3.1 Sampling

Samples were taken of the various soil types encountered in the testpits and these were taken to our laboratory for further testing and examination. We will retain the portions left after testing for a one year period at which time we will dispose of them unless you advise us otherwise.

...4

2.3.2 Laboratory Testing

Laboratory testing conducted on samples from site #24 indicate natural moisture contents, shown on the testpit logs, varying between 11% and 26%. Generally moisture contents are greater than 17% which is indicative of a large fines content within the till. Sieve analyses of three samples from site #24 are plotted on fig. 1 of Appendix II.

3.0 GEOLOGY & TOPOGRAPHY

3.1 General

Most of the testpits in Site #28 were conducted on areas which had been stripped of topsoil, that is, access roads, etc. Where topsoil was encountered it typically consisted of about 0.1m of forest floor humus along with an underlying mineral horizon totalling about 0.3m of topsoil thickness. Some sites had been cut over recently or within the last decade and exhibited small thick growth. Site #119 exhibited mature hardwoods typical of ridges and low water table. Most of site #24 also had such hardwoods. In the lower fringe areas of site #24 soft woods dominated and, typically, these were indicative of a shallower water table.

...5

Geological mapping of the surficial geology by A.D. Pronk & M.A. Parkhill (ref. 2 - (All such references herein refer to appendix I of Report S167)) reveal the variation in the ablation till between sites #28 and #24. The latter site exhibits a finer gradation and is more reflective of the relatively soft underlying weathered shale which lacks the volcanic clasts present in the area of site #28.

Granular aggregate resource mapping of the area (ref. 3) reveal outwash deposits in the area. An esker (ref. 2) is shown on the easterly side of the Belanger Road in the area between Berry Brook and Lost Pine Lake. A suitable deposit was in fact encountered in our examination of Site #29 located in this area (tp#3). Such deposits would provide suitable granular borrow for construction.

3.2 Site No. 119

This site is wholly within a bedrock controlled ridge. An access road exists centrally and along the whole of the site longitudinally. An aerial view reveals that it is largely hardwoods. During a vehicle reconnaissance, many bedrock outcrops were observed along this road. Furthermore a camp was observed within the site. No testpits were done since this site was, on the basis of these observations, deduced to be unsuitable.

...6

3.3 Site No. 28

This site which was located South of the Belanger Road partially in areas which have been cut in the last 5 years or so.

This general area of site #28 exhibits shallow till overburden. Frequent bedrock outcrops of metasediment are visible on the bulldozed woods roads which access the subject area. The overburden is relatively well drained, is primarily silty sand and gravel providing good trafficability without rutting.

All of the testpits conducted within Site #28 (a total of 8) revealed bedrock at depths between 0.1 and 1.2m further confirming the shallowness of the bedrock surface.

3.4 Site No. 24

This is a large site comprising sloping ground in much of the western end. Consequently, our investigation focused on the eastern end having a spacious and large, relatively level area, within and above the 300m contour. A total of 14 testpits were done in this section of site #24 which is a forested area about 2km from the Belanger Road. (See the fig. 2 of appendix III).

...7

The testpits all revealed overburden comprising silty sand, gravel and cobbles till. On the northerly flank, the overburden thickness was, overall, found to be 2.5m or greater to bedrock.

4.0 GEOTECHNICAL CONDITIONS

4.1 Till

Both sites #28 and #24 contained cohesionless till. Site #28 till was noticeably coarser and gravelly in composition. The till of site #24 although cohesionless contained a higher proportion of fines (passing #200 sieve). The few boulders that were encountered tended to be platy shale fragments derived from the local bedrock. The cobble fragments tended to be friable breaking readily into platy fragments. The till was homogenous, generally cohesionless, without sorting and very similar in composition throughout the study area. The testpits stood open for the duration of the excavation. Three grain size analyses were conducted on the minus 40mm minus portions of samples of this till, the results of which are shown on fig.1 of appendix II.

4.2 Groundwater

Groundwater was encountered only in site #24 in testpits #2 at 1.9m depth and #5 at 0.1m depth; in each case coinciding with the bedrock surface.

...8

In testpit #2 the bedrock could be excavated and the broken rock consisted mainly of cobble sized fragments. When a bucket full of bedrock was so removed, groundwater almost immediately filled the void, indicating a very pervious condition within this weathered zone of bedrock.

4.3 Bedrock

Bedrock was encountered in all testpits. In the shallow testpits in which it could be readily viewed, it was dark grey shale often with near vertical beds. In most testpits it was sound and could not be excavated. Highly weathered bedrock was encountered in testpit #1. As discussed in the previous section, moderately weathered bedrock could be excavated producing cobble sized fragments between 1cm and 10cm thick.

As discussed previously, site 119 exhibited bedrock outcrops frequently along the access road which traverses the ridge longitudinally. This bedrock was a metasediment similar to the bedrock encountered in site #28, except that it was more resistant and less weathered as would be expected in the case of such a pronounced ridge.

...9

5.0 DISCUSSION AND RECOMMENDATIONS:

5.1 Site Morphology

As discussed previously, the site, No. 119 consisted of a prominent ridge and steep slopes. This restricts the use of this site. Furthermore, access roads would require long uphill climbs and their construction would likely involve extensive bedrock excavation by blasting.

Both of sites 28 and 24 are large relatively flat or gently sloping sites and, on the basis of surface morphology alone, they would provide suitable areas for a facility.

5.2 Overburden Characteristics

Overburden depth was found to be inadequate on both of sites 28 and 119.

...10

Much of site 24 exhibited suitable overburden depth and characteristics.

Figure 1 of appendix II indicates that the till of Site No. 24 contains of 18% to 51% fines. Illustration 1 of report S167 reproduced below, indicates that such soil would have permeability in excess of 10^{-7} cm/sec.

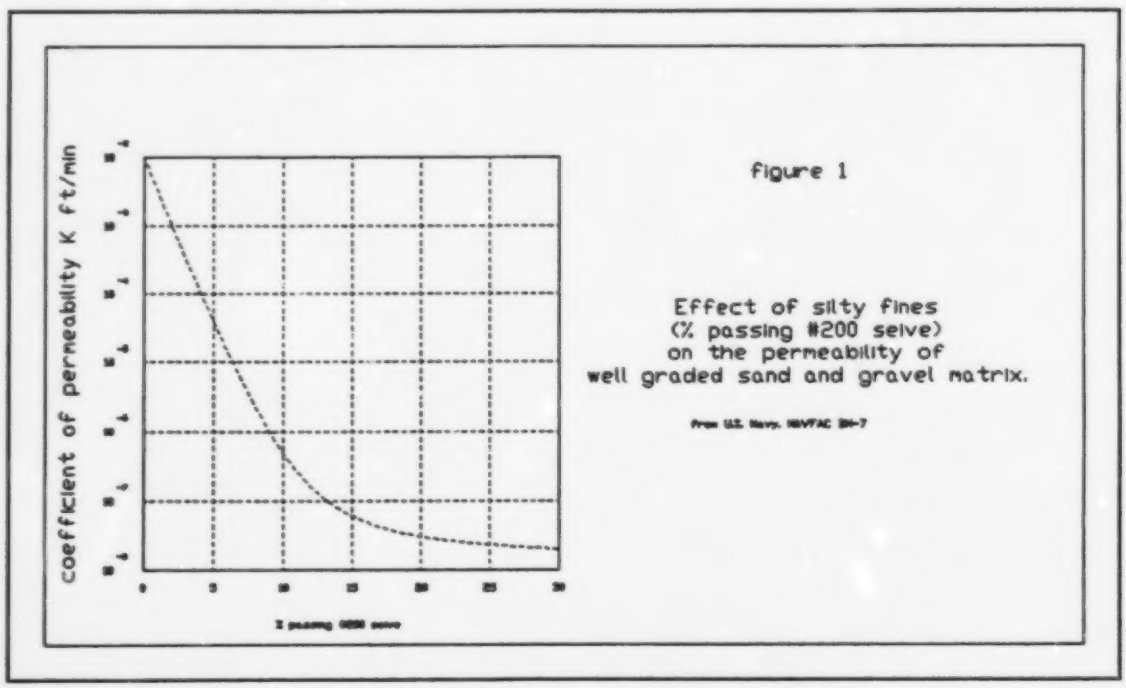

Figure 1

Effect of silty fines
(% passing #200 seive)
on the permeability of
well graded sand and gravel matrix.

From U.S. Navy, NAVFAC DM-7

The cobbles of site #24 were noticeably friable and as a result earthworks and compaction of this soil would be expedited.

During the Phase II survey of site #24 the testpits should be pinpointed and marked for future reconstitution.

5.3 Groundwater

Groundwater was encountered only within the lower areas of site 24 and this also coincides with the undesirable areas of shallow overburden; ie. the areas of testpits #3 & #5. Within the desirable areas of site #24, some swampy areas were encountered. However, these were located within localized depressions and probably were the result of perched conditions which can be eliminated by suitable drainage provisions.

5.4 Conclusions

From a geotechnical viewpoint, of the three sites examined during this investigation, site #119 is steep, has little overburden, so should be rejected.

Site #28 exhibited very thin overburden overall, and on that basis, is not suitable.

...11

Site #24 revealed a zone herein described which exhibited adequate overburden depth. The overburden contains a high percentage of fines and so would be relatively impervious (having a low hydraulic conductivity). The water table is below the bedrock surface and accordingly this portion of site #24 appears suitable and is recommended for phase II examination. The area of the site that provides the desirable characteristics is essentially an oblong height of land above the 305m contour of Figure 2 of Appendix III. This area actually extends out of the originally delineated area in a north-easterly direction to the vicinity of the bulldozed access road. If insufficient conditions are found to exist within the originally intended area, it should be noted that the elevations further on in the north-easterly direction rises, and surface drainage is back toward the delineated area. Accordingly the intent of the 500m set-back from the nearest water course, would not be compromised by including, if necessary, all of the area within the phase II investigation within the 305m contour out to the bulldozed road

6.0 CLOSURE

This report was written by Mr. T.J. Buckley, P.Eng. Drafting and laboratory testing was provided by Ms. Lori Sivret CET. Should the reader have any questions concerning this report please contact Buckley & Associates Ltd.

APPENDIX I
TESTPIT LOGS

job#: S167
technician: TJB
drill date: 01/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP # 24/1

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil						0.0
		brown-grey silty sand and gravel and cobbles (till)						0.5
								1.0
							nil	
			wc = 10.8%	1	cs			1.5
		grey till and highly weathered shale bedrock						2.0
								2.5
		moderately weathered shale bedrock						3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 01/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP # 24/2

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil						0.5
		brown-grey silty sand and gravel and cobbles (till)						1.0
								1.5
		moderately weathered shale bedrock					▼	2.0
								2.5
								3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 01/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP # 24/3

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil						0
		brown-grey silty sand and gravel and cobbles (till)	wc = 18.2 %	1	cs		nil	0.5
								1.0
		sound shale bedrock						1.5
								2.0
								2.5
								3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 01/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP #24/4

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil						
		brown-grey silty sand and gravel and cobbles (till)	wc = 18.2 %	1	cs		nil	
		sound shale bedrock						0.5
								1.0
								1.5
								2.0
								2.5
								3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 01/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP #24/5

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil					▼	
		moderately weathered shale bedrock						0.5
								1.0
								1.5
								2.0
								2.5
								3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 01/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP # 24/6

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil					nil	
		sound shale bedrock						0.5
								1.0
								1.5
								2.0
								2.5
								3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 01/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP #24/7

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil						0.5
		brown-grey silty sand and gravel and cobbles (till)						1.0
			wc = 18.6 %	1	cs		nil	1.5
								2.0
		sound shale bedrock						2.5
								3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 01/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP # 24/8

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil						0
		brown-grey silty sand and gravel and cobbles (till)					nil	0.5
								1.0
								1.5
								2.0
								2.5
		sound shale bedrock						3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 01/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP #24/9

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil						0.0
		brown-grey silty sand and gravel and cobbles (till)	wc = 16.4 %	1	cs		nil	0.5 1.0 1.5 2.0 2.5 3.0
		sound shale bedrock						3.5 4.0 4.5

job#: S167
technician: TJB
drill date: 01/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP #24/10

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil						0.0
		brown-grey silty sand and gravel and cobbles (till)					nil	0.5 1.0 1.5 2.0 2.5 3.0
		sound shale bedrock						3.5 4.0 4.5

job#: S167
technician: TJB
drill date: 01/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP #24/11

PROJECT: Roy/Restigouche

datum: geodetic ELE (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil						0
		brown-grey silty sand and gravel and cobbles (till)					nil	0.5
								1.0
								1.5
		sound shale bedrock						2.0
								2.5
								3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 01/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP #24/12

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil						0.0
		very dense brown-grey silty sand and gravel and cobbles (till)	wc = 26.0 %	1	cs		nil	0.5 1.0 1.5 2.0 2.5 3.0
		end of testpit (no bedrock)						3.5 4.0 4.5

job#: S167
technician: TJB
drill date: 01/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP #24/13

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil						0
		brown-grey silty sand and gravel and cobbles (till)					nil	0.5
								1.0
								1.5
								2.0
		sound shale bedrock						2.5
								3.0
								3.5
								4.0
								4.5

Buckley & Associates ltd.

job#: S167
technician: TJB
drill date: 01/06/92

TESTPIT LOG

TP #24/14

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil						0
		brown-grey silty sand and gravel and cobbles (till)					nil	0.5 1.0 1.5 2.0 2.5 3.0
		sound shale bedrock						3.0 3.5 4.0 4.5

job#: S167
technician: TJB
drill date: 21/06/92

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TESTPIT LOG

TP # 28/1

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		brown silty sand, gravel and cobbles (till)						0.5
		brown-grey silty sand, gravel and cobbles (till)					nil	1.0
								1.5
		medasediment bedrock						2.0
								2.5
								3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 21/06/92

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TESTPIT LOG

TP # 28/2

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		topsoil					▼	0
		brown silty sand, gravel and cobbles (till)						0.5
		medasediment bedrock					perched water	1.0
								1.5
								2.0
								2.5
								3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 21/06/92

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TESTPIT LOG

TP #28/3

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		brown-grey silty sand, gravel and cobbles (till)					nil	0.5
		medasediment bedrock						1.0
								1.5
								2.0
								2.5
								3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 21/06/92

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TESTPIT LOG

TP # 28/4

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		brown silty sand, gravel and cobbles (till)	wc = 29.3 %	1	cs		nil	0.5 1.0 1.5
		medasediment bedrock						2.0 2.5 3.0 3.5 4.0 4.5

job#: S167
technician: TJB
drill date: 21/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP # 28/5

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		brown-grey silty sand, gravel and cobbles (till)					nil	0.5
		metasediment bedrock						1.0
								1.5
								2.0
								2.5
								3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 21/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP #28/6

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		brown silty sand, gravel and cobbles (till)					nil	
		medasediment bedrock						0.5
								1.0
								1.5
								2.0
								2.5
								3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 21/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP #28/7

PROJECT: Roy/Restigouche

datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		brown-grey silty sand, gravel and cobbles (till)					nil	0.5
		medasediment bedrock						1.0
								1.5
								2.0
								2.5
								3.0
								3.5
								4.0
								4.5

job#: S167
technician: TJB
drill date: 21/06/92

Buckley & Associates ltd.

TESTPIT LOG

TP #28/8

PROJECT: Roy/Restigouche

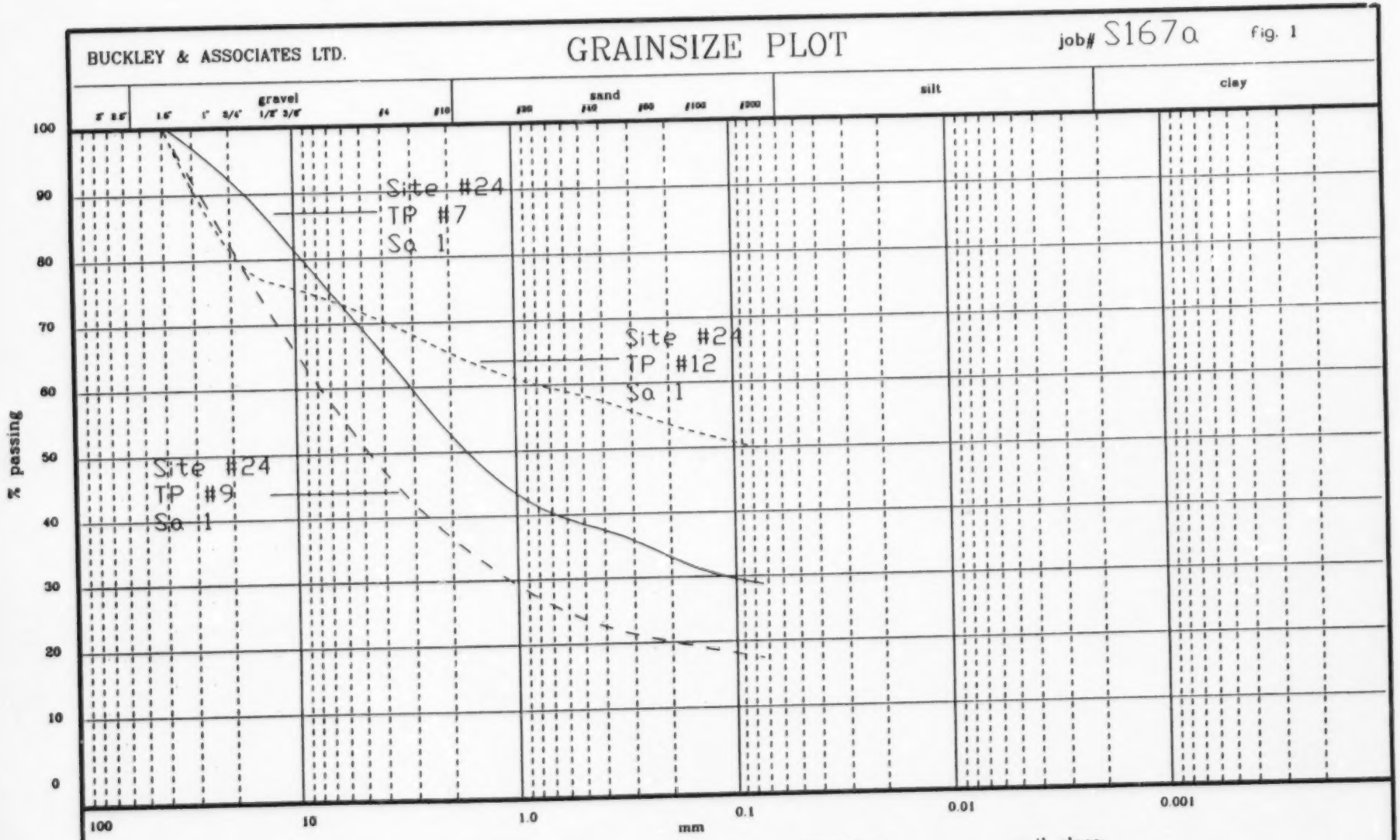
datum: geodetic ELE. (M)	strata plot	description & plotted test results	laboratory classification	sample No.	sample type	N or RQD	groundwater	DEPTH (m)
		brown-grey silty sand, gravel and cobbles (till)					nil	0.5
		metasediment bedrock						1.0
								1.5
								2.0
								2.5
								3.0
								3.5
								4.0
								4.5

APPENDIX II
LABORATORY TEST RESULTS

BUCKLEY & ASSOCIATES LTD.

GRAINSIZE PLOT

job# S167a fig. 1



location:	bh/tp#	depth:	sample #:
Site #24	TP #7	1.5m	1
Site #24	TP #9	1.5m	1
Site #24	TP #12	1.6m	1

soil class:

silty sand, gravel & cobbles till

APPENDIX III
SITE PLANS

Study Area
(See Fig 2)
Site
24
bedrock
outcrop
(typ)
T8
T9
R
T4
T3
T2
T7
T6R
T6
R
SITE 29

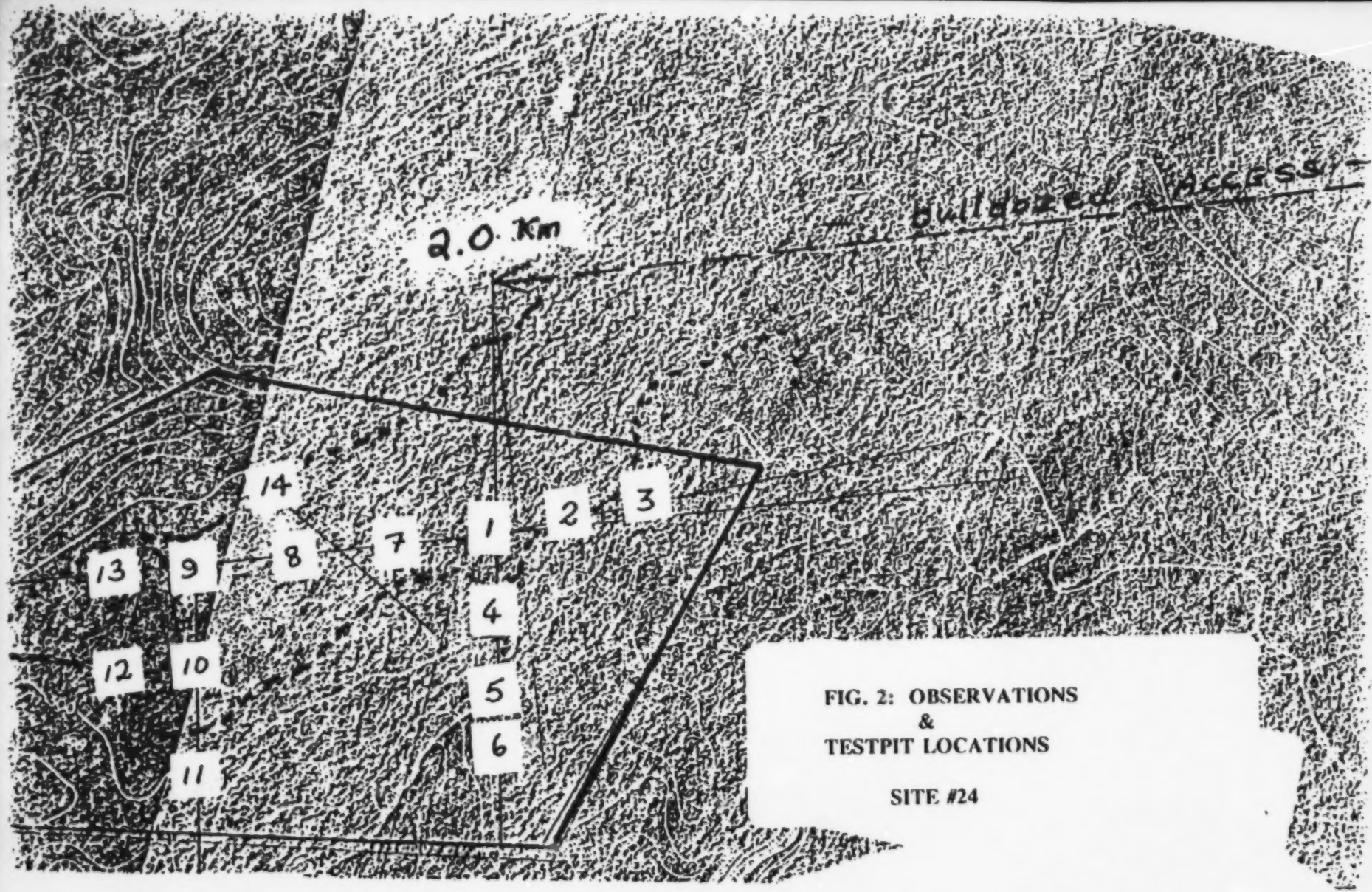


FIG. 2: OBSERVATIONS
&
TESTPIT LOCATIONS

SITE #24

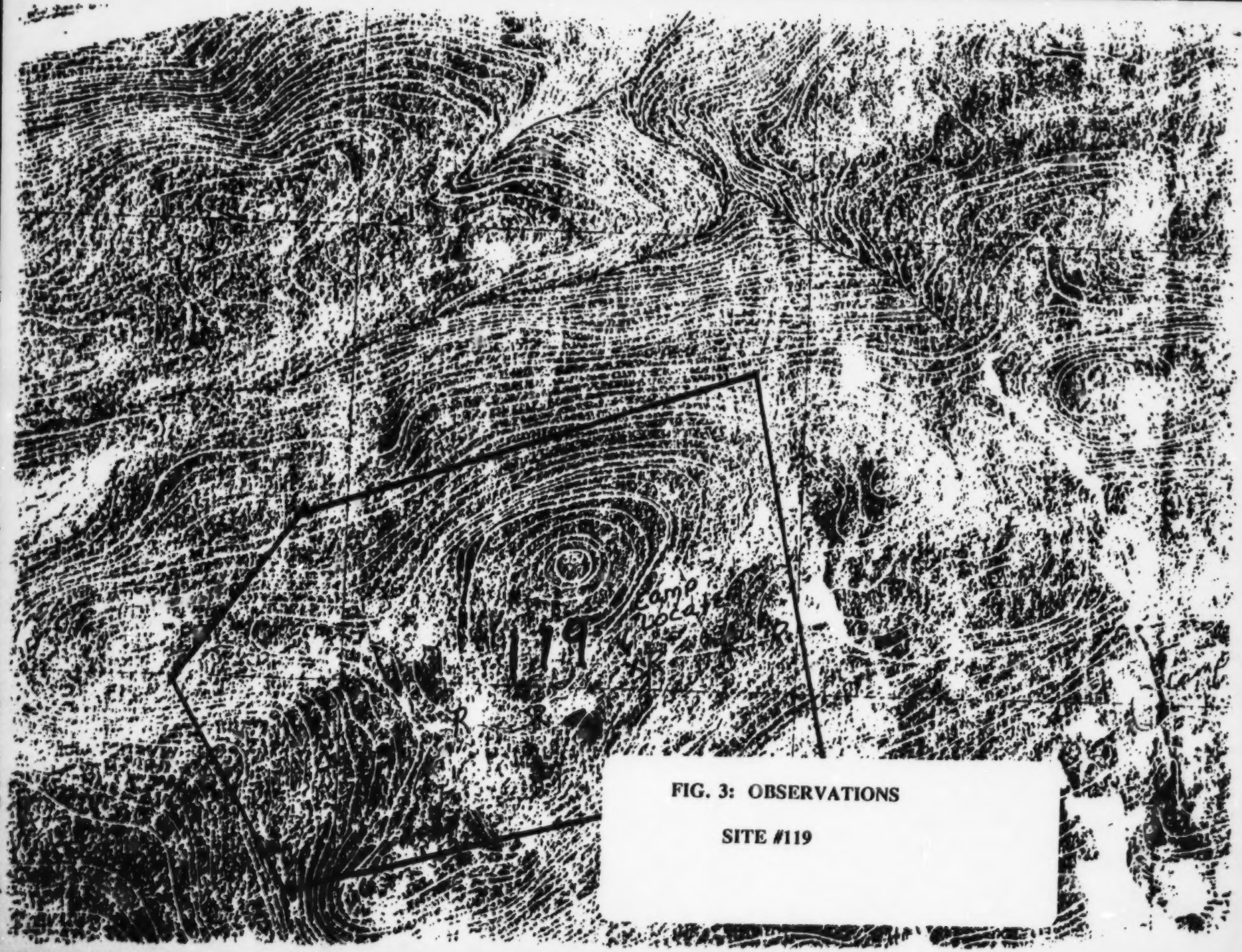


FIG. 3: OBSERVATIONS

SITE #119

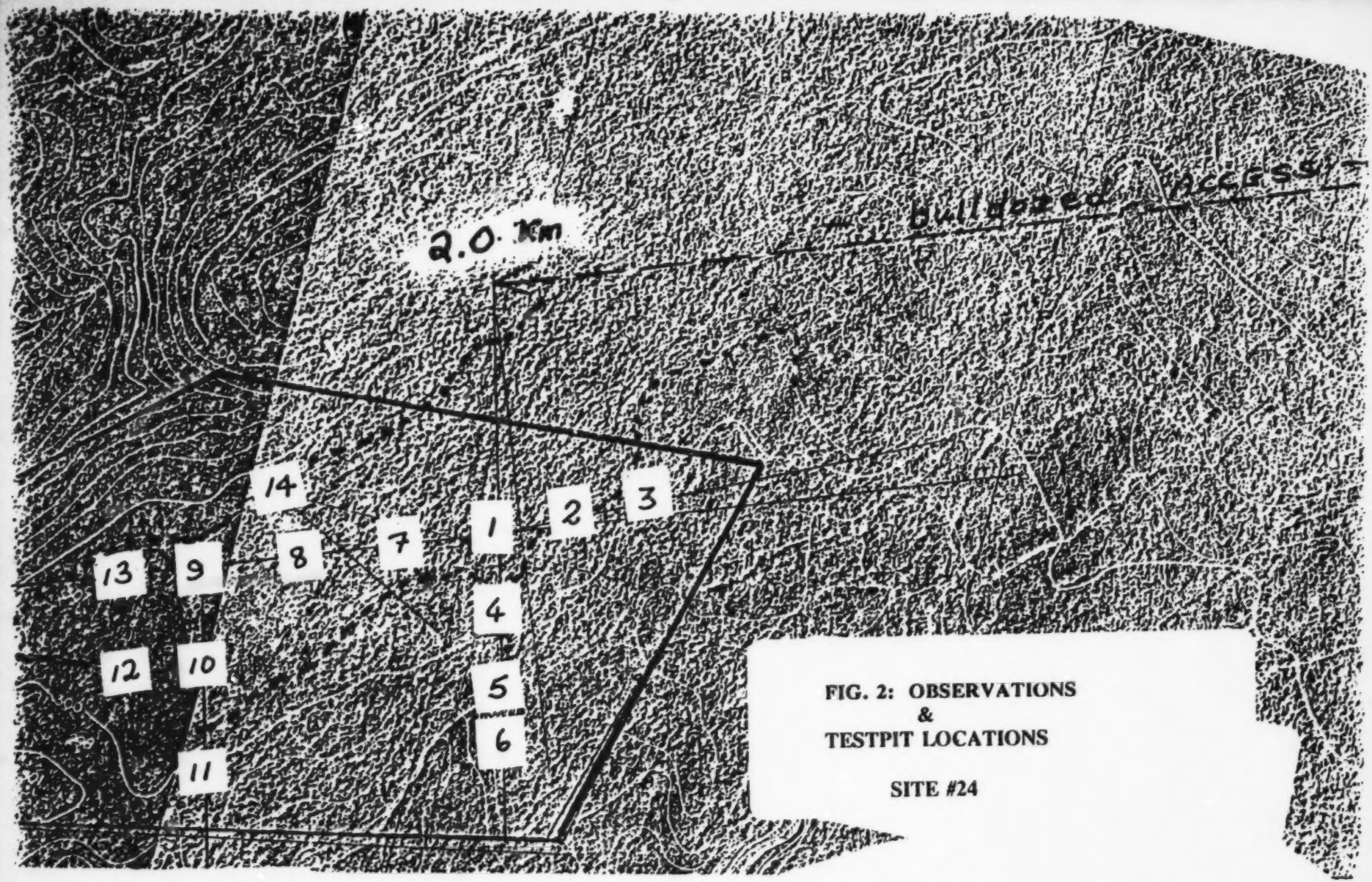


FIG. 2: OBSERVATIONS & TESTPIT LOCATIONS

SITE #24

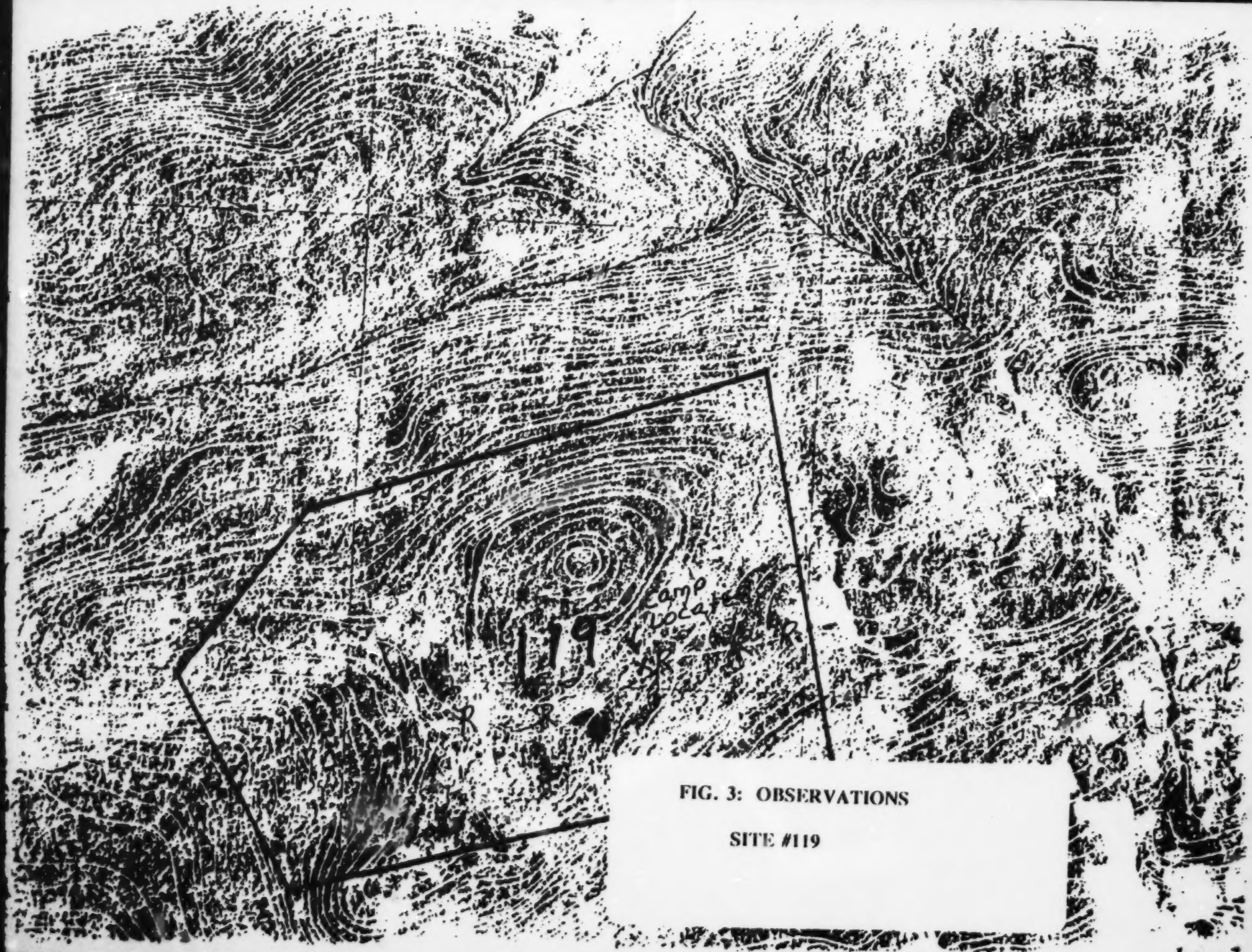


FIG. 3: OBSERVATIONS

SITE #119